Improving Mill Efficiency

Presentation

To

IGFA

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What is Efficiency?

- It is **Not** a destination
- It is a **never ending** journey / constant / built in / lifestyle
- Objective is sweating assets & **reducing cost**
- Much always wants more & its **everyone's concern**
- “Wanton Waste is a **MORTAL SIN**”

Presentation

- Introduction …….. Process & Cost Areas
- Principals & Practice ……. Specifics & Detail
- Implementation …….. How to
- Impediments …….. The devil in the detail
- Success & Software ……. A few examples
- Summary …….. Questions & Answers

Plant Areas

- Intake & Raw Material Storage
- Blending … Weighing, Grinding, Mixing
- Processing .. Pelleting, Extrusion, Mash, Drying & Cooling
- Bulk Storage, Out Loading

Areas to increase efficiencies

- Raw materials
- Transport
- Electrical energy
- Steam Energy
- Air Energy
- Plant consumables, wear & maintenance
- People

First Principal

Time = Money²

- ***If it is taking longer then it is costing someone more***
- **If you reduce time it will reduce most variable cost**
- ***Easier to make €10 / tonne inside than outside the gate***

Second Principal

Data and then more Data

- **Facts are always friendly**
- **Unsubstantiated opinions don't count**
- **Measure consistently, adjust and measure again**

Third Principal

Flat Out or Dead Stop

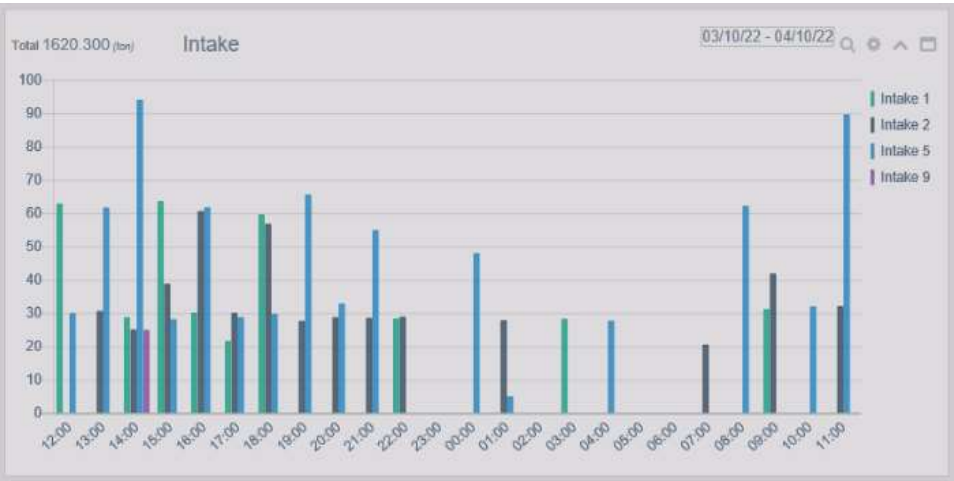
- **If its not processing feed it should not be running**
- **If it is running it needs to be at maximum throughput**

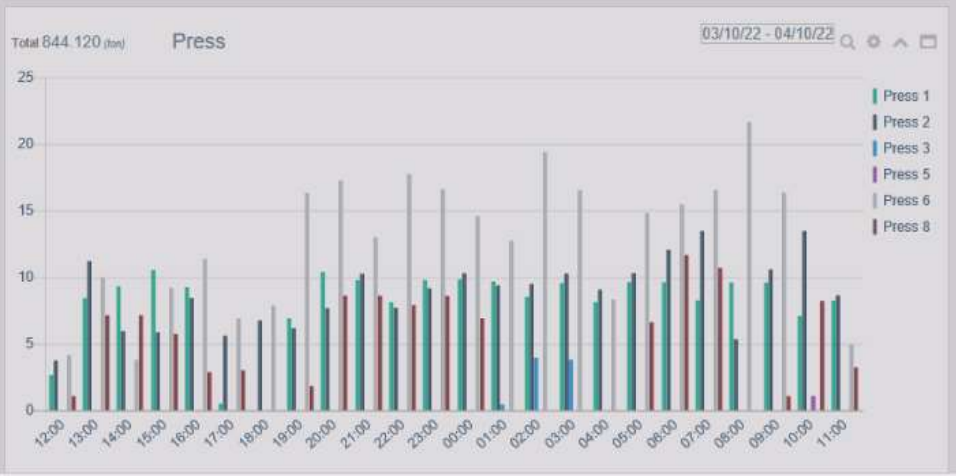
Fourth Principal

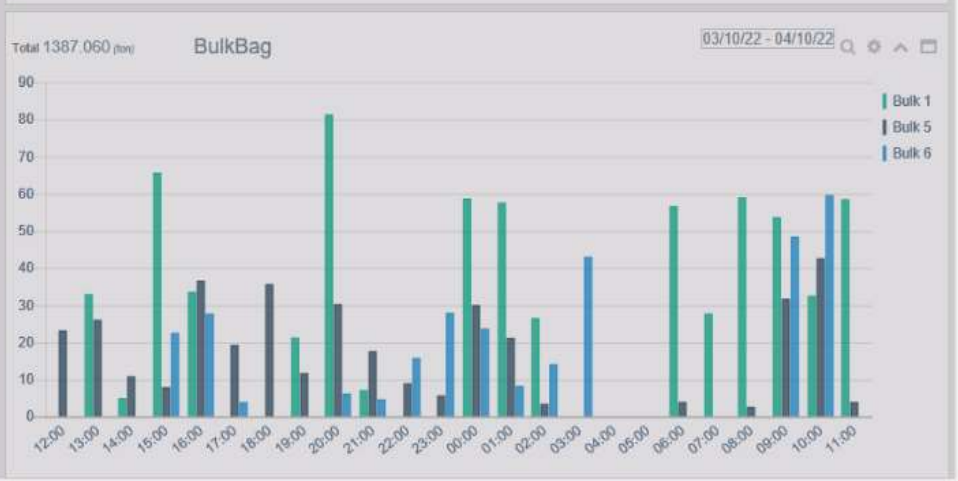
Key Performance Indicators

- **KWs / Tonne, Oil / Gas / Tonne, TPH, Raw material fidelity, Transport turnaround time, Product yield, Quality, Tonnes / Production hours, Downtime, Waste and rework.**
- **Set up consistent (automatic if possible) measurement, Review consistently, Meet and discuss, Daily pulse, Weekly / Monthly meetings with all concerned, Action improvements, Refine, achieve and move the bar up.**
- **Dashboards, Reports, Alerts & Alarms**

Dashboard example







Turning Iron Cost Rule Applies to all plant

- **Example turn on 1 grinder plant, Idle load 100 KW**
  - **Feeder, grinder, fan, transport**
- @ 20c / KW = €20 per hour = €42K p.a. (8 hour day) (idle)
- Load to 20 TPH @ 100 idle + 100 production = 200 KWs = €40 / 20t = €2 per tonne
- Load to 40 TPH @ 100 idle + 200 production = 300 KWs = €60 / 40t = €1.50 per tonne (saving 50c / T)

- **Rule "Increasing TPH dilutes Turning Iron Cost"**
  (if this is all you take away then let it be this)

Efficiency Killers

- **Humans …. Keep them out of the equation**
- Hand tips ….. Minimise or eliminate
- Lack of or poor planning ….. Make planning a priority
- Small batch sizes and short runs
- Flushing
- Late orders
- Specials (below a truck load)
- Ground maize / yellow meal (1 to 2 hours a day)
- Substitutions / Formula changes …. **A Very Big Cost**
- Material double handling **€2 / €3 a tonne**

Intake & Storage

- Automate if not already … Driver operated
- Links with Business system … Expected load concept
- Bigger is always better .. Intake hoppers, Bins, Intake
- Intake hopper takes a full load .. Discharge & Go (ideal)
- Bins …. 50 to 60 tonnes (ideal)
- Intakes 200+ TPH (ideal)
- All intakes should have access to all bins (ideal)
- Bin level probe constant measurement .. BUT be careful
- **Benefits Transport turnaround, Right material / right bin, Minimise subs and changes, Reduces bin checks**

Blending batch size

- 3T batch size is 22% more efficient than 2T
- 4T batch size is 17% more efficient than 3T
- 5T batch size is 12% more efficient than 4T
- Consider if buying a new mixer
- Beware of weighers & grinder bins, May need increasing
- Beware of making 1 or 2 tonne batches on larger mixers

Primary Weighing

- Eliminate / convert / split trough weighers .. Will double TPH
- Smart weighing .. VSD's .. Multi bin feeding .. Cross weigher auto splits .. Weigher feed balancing .. Increase feeders with sprockets, pulleys, bigger motors / gearboxes, NO double dumping / Increase weigher size
- Replace feeders with slides .... Large inclusion bins in right position
- Increase transfer conveyors / elevators (VSD's sprockets / pulleys)
- Smart batch sizing .... 48T run @ 4T = 12 batches .. 10% liquids = 43.2 T = 11 batches (10 x 4T + 1 x 3.2T) ... BEWARE of hand tips
- **300 sec cycle (12 B/H) reduced by 30 sec = 13.3 B/H = + 53 batches per week = +213 tonnes / week**

Mins / Vits / Micro Weighing

- More the better ….. Downstream of Grinding
- 2 / 3 tonne bin sizes min 40 T Bins for larger inclusions
- Butterfly valves on feeders plus inclined feeders
- Be aware of vibration …. Accuracy issue
- Be very aware of air pressures in design (**HUGE ISSUE**)
- Design filling **properly**
- Using air transfer, **suction** rather than blowing
- **Increases TPH (remove hand tips), Reduces raw material cost, Validates inclusion, Reduces grinder beater wear**

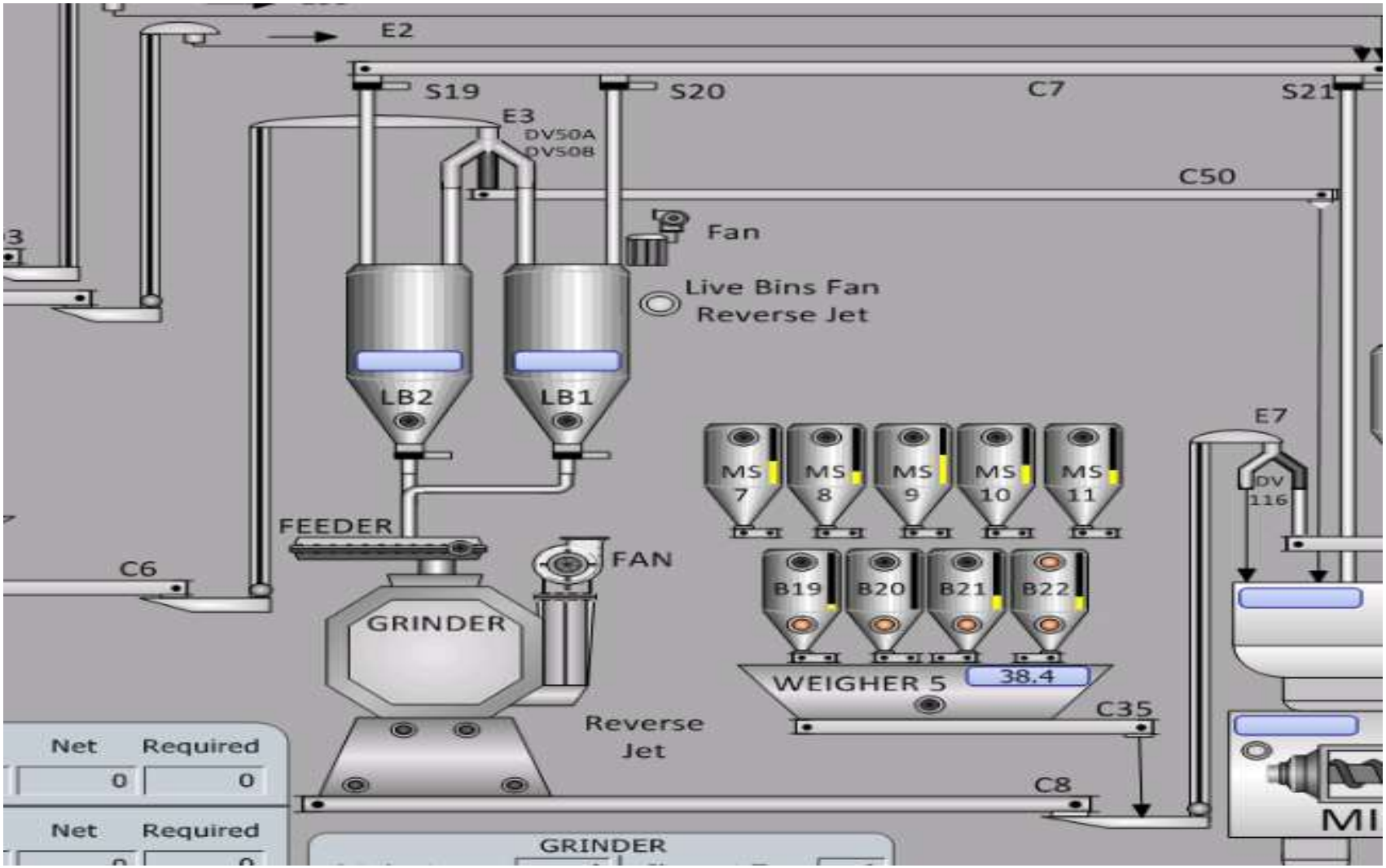
Grinding …. +25% total mill energy

- **Up to 28% of energy is wasted in an unoptimized batch grinding system**
- Grinding is half about impact and half about air
- Air leaks = a square function, 10mm leak = x a 20mm leak = x^2
- Air always takes the least line of resistance
- Badly designed or maintained run at below 60% efficiency
- **Most grinder controllers don't or can't red line the Grinder**
- Most automation systems don't or can't feed forward
- **Increases TPH usually 20% on new grinder and 50% on older system**

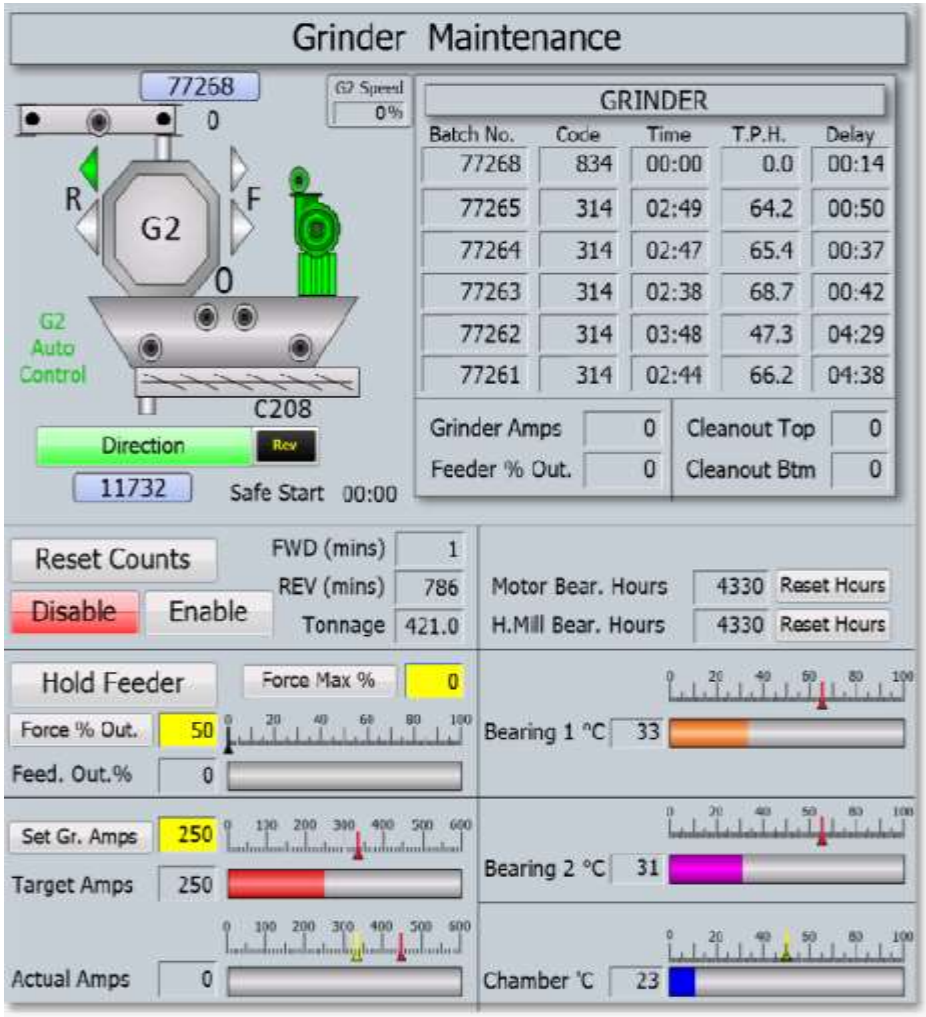
Grinding Common Issues

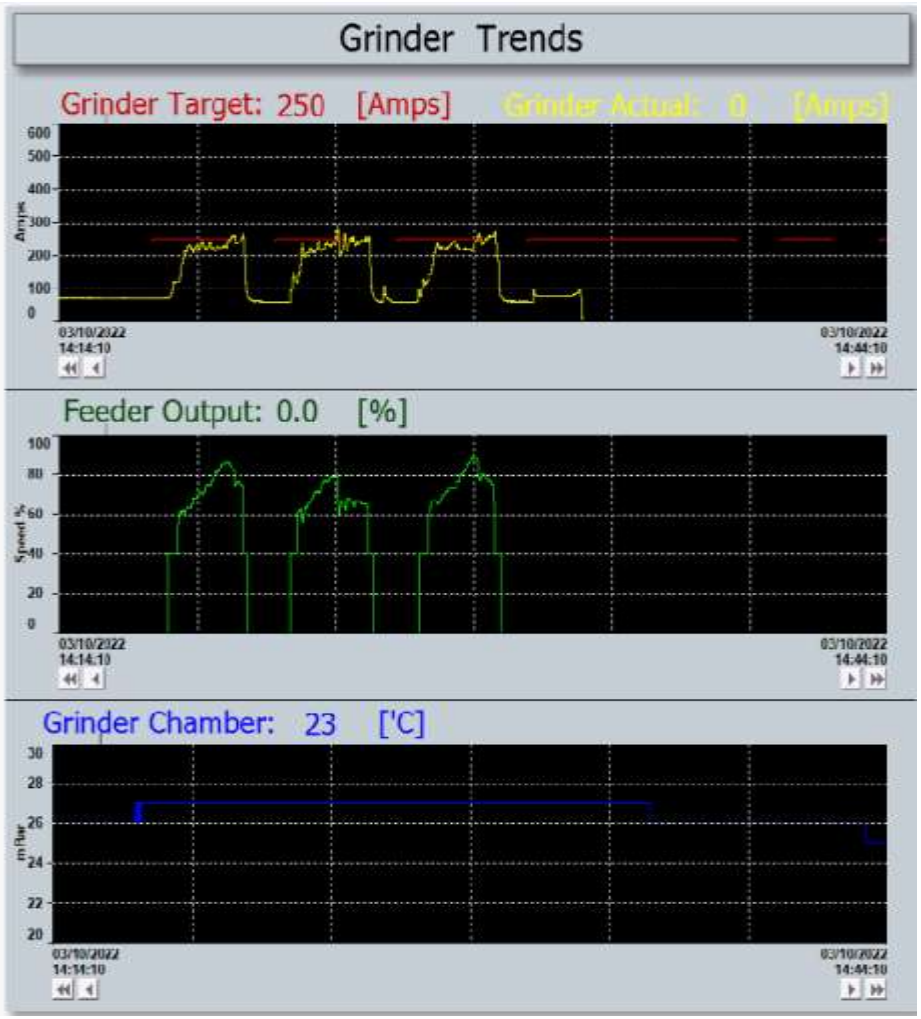
- **Air leaks**
- No air lock rotary seal or a good flap
- Air system not maximised
- Socks not changed frequently
- Reverse jet cleaning not working correctly
- No proper material spreading
- No feed forward
- Poor feeders
- Inefficient controllers
- **Grinders running between batches**

Grinding Feed Forward explained



Grinding Machine Learning





Pelleting +60% of mill energy

- **Unoptimized Pelleting Lines run @ below 80% efficiency …. Some as low as 50%**
- Pelleting … Conditioning … Forming …. Cooling
- Presses should run at least 90% full load
- Conditioners not optimised … Not maintained or cleaned
- Bad steam, Poor steam sets, Run on temp rather than meters
- VSD's on pellet mills and conditioners are highly effective
- **Rolls not set correctly … Dies too thin … No auto roll adjustment or RSM**
- **Operators running at below the TPH of the last disaster**
- **Increases TPH usually 15% on new pellet line and 50% on older lines**
- **Embedded machine learning per formula**

Coolers

- **Cinderella of a lot of feed mills**
- Double deck coolers are a no brainer decision
- *Show analysis tool*
- Correct product spreading is a serious issue
- Air leaks … old or badly designed air handling
- ***Some new developments*** …….
- New designed spreaders
- Variable analogue gate control
- Putting the cooler on load cells
- Machine learning air control … reduced energy and reduces dusty nut!!!

Bulk Storage & Out loading

- **Fill and dispatch as fast as possible**
- Driver operated out loading system
- Link to your business system
- **Drivers beating bin … install bin vibration / hammers**
- Follow on loading …. Where long conveying is used
- Splitting bins for small specials … increases bin utilisation
- Distance measuring for shuttle conveyors …. Refines IFC
- Load cells on trucks …. Good for off bridge loading
- Bin level probe constant measurement
- **Truck turnaround improved … Less bin checks**

Yield improvement

- **Dispatch 100% of what you made is the objective**
- **Measure it,** 20 tonne to a bin … see what you get in the truck …. A few products …. Pellets, meals & coarse
- Losses in grinding, in pelleting and in bulk sieving
- How to improve it?
- **Add moisture … 1% to 3% … IT WORKS … Adesco**
- Make better quality pellets …. Better cooling
- Fines / rework costs … 5% fines … 105% production cost
- Measure fines …. See what it is costing
- **Lots of money to be made here, 1% to 3% of sales**

Electrical energy

- **ESB bill .. Complicated … Understand it**
- Download the ½ hour years readings & Analysis
- Metering …. In older mills difficult but worth it
- How to improve it? … Basic analysis will give information
- **Day/night KWs/T, Vacant power, MIC, Power Factor**
- **Control system integrated gives plant & product cost**
- VSD's, A no brainer … particularly grinder, fans, presses
- **Install Metering, At least on pellet lines & Grinders … Steam & gas / oil as well**
- **Move as much production to night as possible (rates)**
- **Try and avail of DSU / DS3 offerings**
- Show example analysis

Steam energy

- **Steam is a specialist subject**
- Meter the boiler … Pellet lines (each) … and utility use
- Metering …. Is expensive …. but well worth it
- Meter oil / gas
- **Over sized boilers are inefficient**
- Boiler over 20 years old …. Get a new one
- **The basics .. Line insulation, steam traps & filters, Treatment and blow downs**

Compressed Air Energy

- **Cinderella number 2**
- Air is 7+ times more expensive than electrical energy
- Meter the air and the compressor & ancillaries
- Leaks and more leaks …. Even new installation
- **Charge the mill, turn off the compressor and see how long it takes to get to 70% and zero pressure**
- Quiet mill … charge lines and listen for leaks
- **Get an audit done … specialist service**
- Avoid blowers if possible
- **Segment air in plant, intakes, out loading in particular**
- Have the control system control the compressors & segmentation
- Compressor more than 15 years old then replace

How to

- **It is an elephant so eat one leg at a time**
- Give someone the responsibility … full time if possible
- Measure where you are …. Data and more data
- Make an educated list and pick one item at a time
- **Pick the low hanging fruit .. Vacant power, TPH benchmarks and KPI's, Compressed air, Moisture control, Grinders, pick one pellet line**
- VSD's on all new installs
- **Get payback to aid more investment**
- You need a champion and is best if it comes from the top
- **Involve everyone and make sure you shout about progress**

Impediments

- **It is change management so it is difficult**
- People will be your biggest issue ..
- Getting buy in from everyone
- Getting in the way of the day job … yours and theirs
- **Operatives …. We always did it this way!**
- **Changes getting false blame for problems**
- Uniformed experts … Mr. Google man
- Loss of face …. You and others …. Fail, fail fast & move on
- Loss of momentum …. Loss of budget

Some Success

- Increasing capacity from 7K to 9K a week and no additional plant
- Increasing blending from 28 TPH to 48 TPH. Pelleting from 16 TPH to 22 TPH no additional pant
- New Pellet line rated 18 TPH to 22 TPH, Old lines @ 5 & 4 TPH to 8 and 6 TPH, Mash from 6 to 7 TPH, Blending 25 TPH to 40 TPH, Grinding from 30 TPH to +50 TPH Production hours from 19 to 12
- New grinder rated 45 TPH to 53 TPH
- Old Grinder from 35 to 55 TPH
- Davidsons … "Look No Hands Production" Worth seeing

Success Davidsons

- Very Efficient plant …. "***Look no hands production***"
- 2 intakes + Liquid + minerals, 3 blending, (main, Coarse, Rough) 40 blend bins, 10 weighers, 2 grinders, 3 mixers, 3 press lines, 60 bulk bins, 2 out loading, 1 packing …. 100% ruminant … no hand tips
- Planning by person in office (not technical), allocates blend line runs and pellet line runs
- Operator has no input into what they will make … next up is next up
- Operator is now process supervisor, gives help when the system asks & monitors quality
- Blending fully auto what's up next gets made if line available
- Press lines fed on auto top up from levels in bins

Success Davidsons

- Press lines min TPH by product benchmarks (automatic)
- Quick change dies on one line 3 mm, 6 mm, 12 mm, 20 minute change 2 men (screw on)
- Intakes and out loading driver operated and RFID
- Golden rule “make only what is needed”
- Golden rule make planning easy for raw materials and avoids bulk bin blocking
- 3 tier / coating / weighing on pellet lines, stocks easier
- Dash boards in office and control room
- Integrated maintenance system
- Integrated energy system
- Fully integrated control to business system

Software

- **Software is easy … Knowing what to do with it is the hard part … Needs Process Engineering**
- New innovations
- **AI** (Artificial Intelligence) Just starting
- **Machine learning** … Already imbedded … Weighing, Grinding and Pelleting, Cooling systems
- **Edge computing Versus Central Servers**…. Getting the machine learning and AI closer to the plant application …. (ML) Already imbedded in all aspect of the systems

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